

What is claimed is:

1 1. An optical transmission path monitoring system for
2 monitoring optical transmission paths by wavelength-division
3 multiplexing probe lights with signal lights of a wavelength
4 division multiplexing optical transmission system provided
5 with:

6 an optical fiber monitoring probe light for monitoring
7 optical fibers which constitute some parts of said optical
8 transmission paths, and

9 an optical amplifier-repeater monitoring probe light for
10 monitoring optical amplifier-repeaters which constitute other
11 parts of said optical transmission paths.

1 2. The optical transmission path monitoring system, as
2 claimed in Claim 1, wherein:

3 the wavelength of said optical fiber monitoring probe
4 light is such a wavelength as makes the wavelength dispersion
5 of group delays over the full length of said optical transmission
6 paths negative, and

7 the wavelength of said optical amplifier-repeater
8 monitoring probe light is such a wavelength as makes the
9 wavelength dispersion of said group delays over the full length
10 of the optical transmission paths positive.

1 3. The optical transmission path monitoring system, as
2 claimed in Claim 1, wherein:

3 said optical transmission paths have a zero dispersion

4 wavelength which makes the wavelength dispersion of group delays
5 over the full length of said optical transmission paths zero,
6 the wavelength of said optical fiber monitoring probe
7 light is on the shorter wavelength side than said zero dispersion
8 wavelength, and

9 the wavelength of said optical amplifier-repeater
10 monitoring probe light is on the longer wavelength side than
11 said zero dispersion wavelength.

1 4. The optical transmission path monitoring system, as
2 claimed in Claim 1, wherein:

3 said wavelength division multiplexing optical
4 transmission system has two-core two-way optical transmission
5 paths, and is provided with a total of four probe lights including
6 said optical fiber monitoring probe light and said optical
7 amplifier-repeater monitoring probe light for delivering to
8 each of the two outward optical transmission paths which said
9 two-core two-way optical transmission paths have, and

10 every one of said four probe lights has a different
11 wavelength from the others.

1 5. The optical transmission path monitoring system, as
2 claimed in Claim 4, provided with:

3 probe light generating means for generating said optical
4 fiber monitoring probe lights and optical amplifier-repeater
5 monitoring probe lights,

6 multiplexing means for multiplexing said probe lights

7 with signal lights and delivering the multiplexed lights to
8 said outward optical transmission path,

9 loop back means for branching reflected light components
10 generating from said probe lights from said outward optical
11 transmission path and coupling the branched lights with signal
12 lights on said inward optical transmission path, and

13 optical detecting means for detecting said light
14 components transmitted by said loop back means and outputted
15 from said inward optical transmission path, wherein:

16 said optical transmission paths are monitored on the basis
17 of the output of said optical detecting means.

1 6. The optical transmission path monitoring system, as
2 claimed in Claim 5, wherein:

3 said optical detecting means optically detects by a
4 coherent light detecting system said light components
5 transmitted by said loop back means and outputted from said
6 inward optical transmission path.

1 7. The optical transmission path monitoring system, as
2 claimed in Claim 6, wherein:

3 said coherent light detecting system is an optical
4 homodyne detection system using said optical fiber monitoring
5 probe light from said inward optical transmission path as receive
6 light and a light partially branched from said optical fiber
7 monitoring probe light from said probe light generating means
8 as local oscillating light.

1 8. The optical transmission path monitoring system, as
2 claimed in Claim 5, wherein:

3 said optical detecting means optically detects by a direct
4 light detecting system said light components transmitted by
5 said loop back means and outputted from said inward optical
6 transmission path.

1 9. The optical transmission path monitoring system, as
2 claimed in Claim 5, wherein:

3 said loop back means is provided with two 2x2 optical
4 couplers inserted into said optical transmission paths and
5 mutually connected by one each of optical terminals.

1 10. The optical transmission path monitoring system,
2 as claimed in Claim 9, wherein:

3 said 2x2 optical couplers are provided with light
4 reflecting means for selectively reflecting said optical
5 amplifier-repeater monitoring probe lights.

1 11. The optical transmission path monitoring system,
2 as claimed in Claim 5, further provided with:

3 means for alternatively selecting said optical fiber
4 monitoring probe lights and optical amplifier-repeater
5 monitoring probe lights for supply to said outward optical
6 transmission path, and monitoring the optical fibers and the
7 optical amplifier-repeaters on a time-division basis.

1 12. An optical transmission path monitoring apparatus
2 for monitoring optical transmission paths by
3 wavelength-division multiplexing probe lights with signal
4 lights of a wavelength division multiplexing optical
5 transmission system provided with:

6 probe light generating means for emitting said probe
7 lights,

8 multiplexing means for multiplexing said probe lights
9 with signal lights and delivering the multiplexed lights to
10 an outward optical transmission path of the optical transmission
11 paths provided with said outward optical transmission path for
12 transmitting signal lights, an inward optical transmission path
13 for receiving signal lights, and loop back means for looping
14 back between said two optical transmission paths, and

15 optical detecting means detecting light components
16 transmitted by said loop back means and outputted from said
17 inward optical transmission path, wherein:

18 said optical transmission paths are monitored on the basis
19 of the output of said optical detecting means.

1 13. The optical transmission path monitoring apparatus,
2 as claimed in Claim 12, wherein said probe lights comprise:

3 an optical fiber monitoring probe light for monitoring
4 optical fibers which constitute some parts of said optical
5 transmission paths, and

6 an optical amplifier-repeater monitoring probe light for

7 monitoring optical amplifier-repeaters which constitute other
8 parts of said optical transmission paths.

1 14. The optical transmission path monitoring apparatus,
2 as claimed in Claim 13, wherein:

3 the wavelength of said optical fiber monitoring probe
4 light is such a wavelength as makes the wavelength dispersion
5 of group delays over the full length of said optical transmission
6 paths negative, and

7 the wavelength of said optical amplifier-repeater
8 monitoring probe light is such a wavelength as makes the
9 wavelength dispersion of said group delays over the full length
10 of the optical transmission paths positive.

1 15. The optical transmission path monitoring apparatus,
2 as claimed in Claim 13, wherein:

3 the wavelength of said optical fiber monitoring probe
4 light is on the shorter wavelength side than a zero dispersion
5 wavelength which makes the wavelength dispersion of group delays
6 over the full length of said optical transmission paths zero,
7 and

8 the wavelength of said optical amplifier-repeater
9 monitoring probe light is on the longer wavelength side than
10 said zero dispersion wavelength.

1 16. The optical transmission path monitoring apparatus,
2 as claimed in Claim 13, wherein:

3 said wavelength division multiplexing optical
4 transmission system has two-core two-way optical transmission
5 paths, said optical transmission path monitoring apparatuses
6 being provided opposite each other, and is provided with a total
7 of four probe lights including said optical fiber monitoring
8 probe light and said optical amplifier-repeater monitoring
9 probe light for delivering to each of the two outward optical
10 transmission paths which said two-core two-way optical
11 transmission paths have, and

12 every one of said four probe lights has a different
13 wavelength from the others.

1 17. The optical transmission path monitoring apparatus,
2 as claimed in Claim 12, wherein:

3 said optical detecting means optically detects by a
4 coherent light detecting system light components transmitted
5 by said loop back means and outputted from said inward optical
6 transmission path.

1 18. The optical transmission path monitoring apparatus,
2 as claimed in Claim 17, wherein:

3 said coherent light detecting system is an optical
4 homodyne detection system using said optical fiber monitoring
5 probe light from said inward optical transmission path as receive
6 light and a light partially branched from said optical fiber
7 monitoring probe light from said probe light generating means
8 as local oscillating light.

1 19. The optical transmission path monitoring apparatus,
2 as claimed in Claim 12, wherein:

3 said optical detecting means optically detects by a direct
4 light detecting system said light components transmitted by
5 said loop back means and outputted from said inward optical
6 transmission path.

1 20. The optical transmission path monitoring apparatus,
2 as claimed in Claim 12, wherein:

3 said loop back means is provided with two 2x2 optical
4 couplers inserted into said optical transmission paths and
5 mutually connected by one each of optical terminals.

1 21. The optical transmission path monitoring apparatus,
2 as claimed in Claim 12, wherein:

3 said 2x2 optical couplers are provided with light
4 reflecting means for selectively reflecting said optical
5 amplifier-repeater monitoring probe lights.

1 22. The optical transmission path monitoring apparatus,
2 as claimed in Claim 12, further provided with:

3 means for alternatively selecting said optical fiber
4 monitoring probe lights and optical amplifier-repeater
5 monitoring probe lights for supply to said outward optical
6 transmission path, and monitoring the optical fibers and the
7 optical amplifier-repeaters on a time-division basis.

1 23. An optical transmission path monitoring method for
2 monitoring optical transmission paths by wavelength-division
3 multiplexing probe lights with signal lights of a wavelength
4 division multiplexing optical transmission system using:

5 an optical fiber monitoring probe light for monitoring
6 optical fibers which constitute some parts of said optical
7 transmission paths, and

8 an optical amplifier-repeater monitoring probe light for
9 monitoring optical amplifier-repeaters which constitute other
10 parts of said optical transmission paths.

1 24. The optical transmission path monitoring method,
2 as claimed in Claim 23, wherein:

3 the wavelength of said optical fiber monitoring probe
4 light is such a wavelength as makes the wavelength dispersion
5 of group delays over the full length of said optical transmission
6 paths negative, and

7 the wavelength of said optical amplifier-repeater
8 monitoring probe light is such a wavelength as makes the
9 wavelength dispersion of said group delays over the full length
10 of the optical transmission paths positive.

1 25. The optical transmission path monitoring method,
2 as claimed in Claim 23, wherein:

3 said optical transmission path has a zero dispersion
4 wavelength which makes the wavelength dispersion of group delays

5 over the full length of said optical transmission paths zero,
6 the wavelength of said optical fiber monitoring probe
7 light is on the shorter wavelength side than said zero dispersion
8 wavelength, and

9 the wavelength of said optical amplifier-repeater
10 monitoring probe light is on the longer wavelength side than
11 said zero dispersion wavelength.

1 26. The optical transmission path monitoring method,
2 as claimed in Claim 23, wherein:

3 said wavelength division multiplexing optical
4 transmission system has two-core two-way optical transmission
5 paths, and is provided with a total of four probe lights including
6 said optical fiber monitoring probe light and said optical
7 amplifier-repeater monitoring probe light for delivering to
8 each of the two outward optical transmission paths which said
9 two-core two-way optical transmission paths have, and

10 every one of said four probe lights has a different
11 wavelength from the others.

1 27. The optical transmission path monitoring method,
2 as claimed in Claim 26, comprising:

3 a step of generating said optical fiber monitoring probe
4 lights and optical amplifier-repeater monitoring probe lights,

5 a step of multiplexing said probe lights with signal lights
6 and delivering the multiplexed lights to said outward optical
7 transmission path, and

8 a step of detecting said light components outputted from
 9 said inward optical transmission path by branching reflected
 10 light components generating from said probe lights from said
 11 outward optical transmission path and looping back the branched
 12 lights onto said inward optical transmission path, whereby:
 13 said optical transmission paths are monitored on the basis
 14 of the output of said optical detecting means.

1 28. The optical transmission path monitoring method,
 2 as claimed in Claim 27, whereby:
 3 said light components outputted from said inward optical
 4 transmission path are detected by a coherent light detecting
 5 system at said step of detecting light components.

1 29. The optical transmission path monitoring method,
 2 as claimed in Claim 28, whereby:
 3 said coherent light detecting system is an optical
 4 homodyne detection system using said optical fiber monitoring
 5 probe light from said inward optical transmission path as receive
 6 light and a light partially branched from said optical fiber
 7 monitoring probe light from said probe light generating means
 8 as local oscillating light.

1 30. The optical transmission path monitoring method,
 2 as claimed in Claim 27, whereby:
 3 said light components transmitted by said loop back means
 4 and outputted from said inward optical transmission path are

5 detected by a direct light detecting system at said step of
6 detecting light components.

1 31. The optical transmission path monitoring method,
2 as claimed in Claim 27, whereby:

3 said optical fiber monitoring probe lights and optical
4 amplifier-repeater monitoring probe lights are alternatively
5 selected for supply to said outward optical transmission path,
6 and the optical fibers and the optical amplifier-repeaters are
7 monitored on a time-division basis.